REMARKS

This application has been carefully reviewed in light of the Office Action dated September 11, 2006. Claims 12, 15, 29, and 30 are canceled without prejudice. Claims 3-8, 11, 13, 14, 16-28, and 31 remain in this application. Claims 5, 11, 18, 19, 25, 27, 28, and 31 are the independent claims. Claims 5, 7, 11, 14, 16, 18, and 19 are amended. It is believed that no new matter is involved in the amendments or arguments presented herein. Reconsideration and entrance of the amendment in the application are respectfully requested.

Art-Based Rejections

Claims 11-14, 17-24, 27, and 31 were rejected under 35 U.S.C. § 102(b) over U.S. Patent No. 5,081,229 (Akahori); Claims 3-8, 15, 16, 25, 26, and 28 were rejected under 35 U.S.C. § 103(a) over Akahori in view of JP 2000-297163 (Tanaka). Applicants respectfully traverse the rejections and submit that the claims herein are patentable in light of the arguments below.

The Akahori Reference

Akahori is directed to a polyimide resin known as a heat-resistant resin and, more particularly, to a novel copolyimide possessing excellent thermal dimensional stability and mechanical properties. (*See, Akahori, column 1, lines 10-14*).

The Tanaka Reference

Tanaka is directed to obtaining a polyimide film having a high modulus and a specified storage modulus by preparing the same from a polyamic acid prepared by reacting p-phenylenebis(trimellitic monoester anhydride) and oxydiphthalic

dianhydride with p-phenylenediamine and 4,4'-diaminodiphenyl ether. (*See, Tanaka, ABSTRACT, Problem To Be Solved Section*).

The Claims are Patentable Over the Cited References

The present invention is directed to a polyimide film.

CLAIM 5

As defined by independent Claim 5, a laminate includes a polyimide film. The invention set forth in Claim 5, as amended, and each of the independent claims relates to the polyimide film that is produced by using a bis(trimellitic monoester anhydride), represented by General Formula (4), as an acid dianhydride component. The invention also relates to a laminate that is produced by using the polyimide film. Further, the invention set forth in the new claims relates to a polyimide film producing method in which p-phenylene bis(trimellitic monoester anhydride) is used as an acid dianhydride component. The invention also relates to a method in which the tan δ peak is controlled to fall in a range of 310°C to 410°C.

The applied references do not disclose or suggest the above features of the present invention as defined by independent Claim 5. In particular, the applied references do not disclose or suggest "a dynamic viscoelasticity whose tan δ peak is located in a range of not less than 310°C but not more than 410°C, and whose tan δ value at 300°C is not more than 0.05," as required by independent Claim 5.

Akahori teaches that (i) a polyimide film that is excellent in thermal dimensional stability and mechanical properties is obtained by contriving a method for copolymerizing a polyimide and (ii) neither warping nor curling occurs when the polyimide film is bonded to a metal. Akahori not only fails to teach or suggest the use of bis(trimellitic monoester anhydride) (hereinafter, "TMHQ"), but also fails to teach or suggest the technical concept of the polyimide film. Specifically, Akahori

does not teach or suggest that (i) a TMHQ is used to control the dynamic viscoelasticity of the polyimide film and (ii) the tan δ peak of the dynamic viscoelasticity of the polyimide film is controlled in the range of 310°C to 410°C, and the tan δ value at 300°C is controlled at not more than 0.05, in order to reduce the thermal shrinkage rate of the polyimide film under high temperature.

Tanaka teaches the use of four components of four kinds of monomers (paraphenylene bis(trimellitic anhydride), oxydiphthalic dianhydride, paraphenylene diamine, diaminodiphenyl ether), which are different from those of the polyimide film used in the present invention. Tanaka teaches the production of a polyimide film of properties (high modulus of tensile elasticity, low coefficient of linear expansion, and low coefficient of hygroscopic expansion) that are required for a flexible printed circuit or the like. However, Tanaka does not teach or suggest the technical concept of the present invention. Specifically, Tanaka does not teach or suggest that (i) a TMHQ is used to control the dynamic viscoelasticity of the polyimide film and (ii) the tan δ peak of the dynamic viscoelasticity of the polyimide film is controlled in the range of 310°C to 410°C, and the tan δ value at 300°C is controlled at not more than 0.05, in order to reduce the thermal shrinkage rate of the polyimide film under high temperature.

Thus, Applicant respectfully submits that there is no motivation for combining Tanaka and Akahori to obtain a polyimide film that is low in thermal shrinkage rate under high temperature. Moreover, even with the combination of Tanaka and Akahori, without knowledge of the technical concept of using a TMHQ to control the dynamic viscoelasticity of the polyimide film, a person skilled in the art would not arrive at the present invention.

Since the cited references fail to disclose, teach or suggest the above features recited in independent Claim 5, these references cannot be said to anticipate nor render obvious the invention which is the subject matter of those claims.

Accordingly, the applied references do not disclose or suggest the features of independent Claim 5.

Claims 3, 4, 6-8, and 26 depend either directly or indirectly from independent Claim 5 and recite additional features of the invention which are neither disclosed nor fairly suggested by the applied references and are therefore also believed to be in condition for allowance.

CLAIM 11

As defined by independent Claim 11, a polyimide film prepared by copolymerizing an acid dianhydride component and a diamine component, the acid dianhydride component including a pyromellitic dianhydride being represented by General Formula (1), a bis(trimellitic monoester anhydride) represented by General Formula (4), and a biphenyl tetracarboxylic dianhydride being represented by General Formula (5), the polyimide film having such an etching speed that one side thereof is etched with a 1N potassium hydroxide solution at an etching speed of 0.1 μm/minute (one side) or higher. The diamine component includes a paraphenylene diamine represented by General Formula (2) and a diaminodiphenyl ether represented by General Formula (3)

The applied references do not disclose or suggest the above features of the present invention as defined by independent Claim 11. In particular, the applied references do not disclose or suggest "the polyimide film having such an etching speed that one side thereof is etched with a 1N potassium hydroxide solution at an

etching speed of 0.1 μm/minute (one side) or higher," as required by independent Claim 11.

Akahori is silent with respect to producing a polyimide film with the use of a TMHQ.

Further, as discussed above, Akahori not only fails to teach or suggest the use of TMHQ, but also fails to teach or suggest the technical concept of the polyimide film. Specifically, Akahori is silent on polymerizing a pyromellitic dianhydride and a biphenyl tetracarboxylic dianhydride, and further copolymerizing with a TMHQ, in order to allow incompatible properties to become compatible with each other.

Tanaka, as discussed above, fails to teach or suggest the technical concept of the polyimide film of the present invention. Specifically, *Tanaka* is silent on polymerizing a pyromellitic dianhydride and a biphenyl tetracarboxylic dianhydride, and further copolymerizing with a TMHQ to allow incompatible properties to become compatible with each other. Namely, Tanaka fails to teach or suggest the polyimide film having such an etching speed that one side thereof is etched with a 1N potassium hydroxide solution at an etching speed of 0.1μm/minute (one side) or higher.

Thus, Applicant respectfully submits that there is no motivation for combining Tanaka and Akahori to obtain a polyimide film that has the etching properties of the present invention.

Since the cited references fail to disclose, teach or suggest the above features recited in independent Claim 11, these references cannot be said to anticipate nor render obvious the invention which is the subject matter of those claims.

Accordingly, the applied references do not disclose or suggest the features of independent Claim 11.

Claims 13, 14, 16, and 17 depend either directly or indirectly from independent Claim 11 and recite additional features of the invention which are neither disclosed nor fairly suggested by the applied references and are therefore also believed to be in condition for allowance.

CLAIM 18

The laminate of independent Claim 18 comprises a metal layer and a polyimide film having the same features as those of the polyimide film of Claim 11.

Accordingly, the applied references do not disclose or suggest the features of independent Claim 18. Claim 18 is therefore, similarly believed to be in condition for allowance.

CLAIM 19

As defined by independent Claim 19, a polyimide film prepared by copolymerizing an acid dianhydride component and a diamine component. The acid dianhydride component includes the pyromellitic dianhydride, represented by General Formula (1), in a range of from 50 mole% to 70 mole%, the biphenyl tetracarboxylic dianhydride, represented by General Formula (5) in a range of from 1 mole% to 40 mole%, and the bis(trimellitic monoester anhydride, represented by General Formula (4), in a range of from 20 mole% to 50 mole%. The diamine component includes the paraphenylene diamine, represented by General Formula (2), in a range of 25 mole% to 75 mole%, and the diamine diphenyl ether, represented by General Formula (3), in a range of 25 mole% to 75 mole%.

The applied references do not disclose or suggest the above features of the present invention as defined by independent Claim 19. In particular, the applied references do not disclose or suggest "the acid dianhydride component including the

pyromellitic dianhydride, represented by General Formula (1), in a range of from 50 mole% to 70 mole%, the biphenyl tetracarboxylic dianhydride, represented by General Formula (5) in a range of from 1 mole% to 40 mole%, and the bis(trimellitic monoester anhydride, represented by General Formula (4), in a range of from 20 mole% to 50 mole%, the diamine component including the paraphenylene diamine, represented by General Formula (2), in a range of 25 mole% to 75 mole%, and the diamine diphenyl ether, represented by General Formula (3), in a range of 25 mole% to 75 mole%," as required by independent Claim 19.

Support for the amendment to claim 19 can be found at p. 83, line 25-p. 84, line 3 of Applicant's specification.

Akahori teaches to produce a polyimide film by using (i) a diamine component including a diamino diphenyl ether and a paraphenylene diamine as essential components and (ii) an acid dianhydride component including a pyromellitic dianhydride and a biphenyl tetracarboxylic dianhydride. However, Akahori is totally silent on using a paraphenylene bis(trimellitic anhydride). Further, Akahori is silent as to using all of the five components (the diamino diphenyl ether, the paraphenylene diamine, the pyromellitic dianhydride, the biphenyl tetracarboxylic dianhydride, and the paraphenylene bis(trimellitic anhydride)) at a specific rate to produce a polyimide film, as is required by independent Claim 19.

As discussed above, Tanaka teaches a polyimide film that is constituted of four components: p-phenylene bis(trimellitic monoester anhydride), oxydiphthalic dianhydride, p-phenylenediamine, and 4,4'-diaminodiphenylether. Tanaka is silent as to an arrangement in which a polyimide film is produced by using the five components (the diamino diphenyl ether, the paraphenylene diamine, the pyromellitic dianhydride, the biphenyl tetracarboxylic dianhydride, and the

paraphenylene bis(trimellitic anhydride)) found in the polyimide film produced according to Claim 19.

Further, Tanaka states in paragraph [0050] that "a slight amount of a diamine monomer component other than the four monomers is added, that is, 10 mol% or less of whole the diamine or 15 mol% or less of whole the acid dianhydride is added, thereby minutely adjusting a property of the obtained polyimide film. This condition depends on which kind of monomer is used, but it is possible to keep the favorable moisture absorption property, the favorable thermal property, and the favorable mechanical property, as long as the copolymerization is carried out with an amount equal to or less than the foregoing amount. As the slight amount of monomer, ... , examples of the acid anhydride include 3,3',4,4'-biphenyl tetracarboxylic dianhydride, 3,3',4,4'-benzophenone tetracarboxylic dianhydride, a pyromellitic dianhydride, 3,3',4,4'-diphenyl sulfone tetracarboxylic dianhydride, and the like." Accordingly, Applicant respectfully submits that Tanaka suggests that it is not preferable to use a large amount of another monomer component such as the pyromellitic dianhydride. Thus, Tanaka "teaches away" from the present invention. Consequently, a person of ordinary skill in the art, based upon the teaching of Tanaka would be discouraged from producing a polyimide film using 50 mol% to 70 mol% of pyromellitic dianhydride in the same manner as that taught by independent Claim 19.

Since the cited references fail to disclose, teach or suggest the above features recited in independent Claim 19, these references cannot be said to anticipate nor render obvious the invention which is the subject matter of those claims.

Accordingly, the applied references do not disclose or suggest the features of independent Claim 19.

Claims 20-24 depend either directly or indirectly from independent Claim 19 and recite additional features of the invention which are neither disclosed nor fairly suggested by the applied references and are therefore also believed to be in condition for allowance.

CLAIM 25

The laminate of independent Claim 25 comprises a metal layer and a polyimide film that has the same features as those of the polyimide film of Claim 19.

Accordingly, the applied references do not disclose or suggest the features of independent Claim 25. Claim 25 is therefore, similarly believed to be in condition for allowance.

CLAIM 27

Independent claim 27 comprises a polyimide film having the same features as those of the polyimide film of Claim 5.

Accordingly, the applied references do not disclose or suggest the features of independent Claim 27. Claim 27 is therefore, similarly believed to be in condition for allowance.

CLAIM 28

Independent claim 28 comprises a polyimide film having the same features as those of the polyimide film of Claim 27 in addition to having a biphenyl tetracarboxylic dianhydride represented by General Formula (5)..

Accordingly, the applied references do not disclose or suggest the features of independent Claim 28 and Claim 28 is believed to be in condition for allowance.

CLAIM 31

Independent Claim 31 comprises a polyimide film having the same features as those of the polyimide film of Claim 5.

Accordingly, the applied references do not disclose or suggest the features of independent Claim 31. Claim 31 is therefore, similarly believed to be in condition for allowance.

Conclusion

In view of the foregoing, it is respectfully submitted that the application is in condition for allowance. Reexamination and reconsideration of the application, in view of the foregoing amendments, are requested.

If for any reason the Examiner finds the application other than in condition for allowance, the Examiner is requested to call the undersigned attorney at the Los Angeles, California telephone number (310) 785-4721 to discuss the steps necessary for placing the application in condition for allowance.

Appl. No. 10/667,134
Amdt. Dated February 12, 2007
Reply to Office Action of September 11, 2006

Attorney Docket No. 89227.0005
Customer No.: 26021

If there are any fees due in connection with the filing of this response, please charge the fees to our Deposit Account No. 50-1314.

Respectfully submitted,
HOGAN & HARTSON L.L.P.

Date: February 12, 2007

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